

## **REMARKS**

### **I. Status of the Claims**

Claims 4 and 6 are currently amended to clarify the present invention. Claims 5, 7, 9, 10, 12 and 16-18 were previously presented. Claims 1-3, 8, 11, 13-15 and 19-24 are canceled without prejudice or disclaimer. Upon entry, claims 4-7, 9, 10, 12, 16-18 will be pending for examination.

### **II. Rejections under 35 U.S.C. 103 (a)**

#### **(1) Josh in view of Fukami and Herrington**

Claims 4-7, 10, 12, and 16-18 are rejected as allegedly being obvious over WO-0216482 or U.S. Patent Pub No. 2003/0176561 (“Joshi”) in view of U.S. Patent No. 5,071,613 (“Fukami”) and U.S. Patent No. 5,032,622 (“Herrington”). Office Action, page 2. Specifically, the Examiner asserts that “Joshi discloses a process for the preparation of fiber reinforced composites in which the matrix polymer is derived from the catalyzed reaction of a liquid polyisocyanate containing material” and a “polyisocyanate component contain[ing] bifunctional and trifunctional MDI-components ... that are liquid at room temperature and the reaction product of the MDI-components with polyols.” Office Action, page 2-3.

The Examiner further asserts that “a person of ordinary skill in the art would have selected lower molecular weight in the ranges disclosed by Fukami” because “discovering an optimum value of a result effective variable only involves routine skill in the art.” Office Action, page 3-4.

Moreover, the Examiner asserts that Herrington “teaches cured thermoset shape memory polyurethane that is the reaction product of di and tri-functional polyisocyanate and di and tri-functional polyol.” Office Action, page 4. For the reasons that follow, Applicants respectfully disagree.

**(A) None of the cited references teaches polymerizing or curing an isocyanate component and a polyol component *without* using any catalyst**

To expedite prosecution of this application without acquiescing to the Examiner's rejection, Applicants amend claims 4 and 6 to clarify that the claimed composition may only consist of an optional component "other than isocyanate, polyol and curing catalyst." That is, the claimed invention excludes any curing catalyst.

Unlike the claimed invention, Joshi, Fukami and Herrington all disclose a polymerization process using a catalyst. For example, Joshi is directed to form polyisocyanurate by a trimerization of isocyanate groups *by a catalyst*. Joshi, Abstract, page 14 at lines 28-34 and Example 14. The Examiner in fact acknowledges that "Joshi discloses a process for the preparation ... in which the matrix polymer is derived from the *catalyzed* reaction of a liquid polyisocyanate containing material." Office Action, page 2, emphasis supplied. Fukami uses "an organic acid salt of a tertiary amine ... as the curing *catalyst*." Column 2, line 14-15, emphasis supplied.

Herrington also fails to teach curing an isocyanate component and a polyol component without using any catalyst. In this regard at least three "Amine catalyst[s]" was used in Herrington. Herrington, Table 1. To be sure, Herrington discloses that the glass transition temperature. i.e., Tg, of a polyurethane can be controlled by the selection of reactant, but Herrington fails to teach or suggest how to achieve both advantageous effects of extending a pot life of the matrix polymer and increasing Tg of the matrix polymer without using any curing catalysts.

**(B) Joshi fails to teach at least three elements of the claimed invention – shape memory characteristic, composition of the isocyanate and the NCO : -OH ratio**

Joshi fails to teach or suggest that the matrix polymer has a shape memory characteristic, despite disclosing fiber reinforced composites in which the matrix polymer is derived from the catalyzed reaction of a liquid polyisocyanate containing material.

In order to achieve a shape memory characteristic, the claimed invention requires an isocyanate which is a mixture *only* consisting of bifunctional and trifunctional isocyanates, and *only* a bifunctional polyol as the isocyanate and polyol components. Unlike the claimed invention, Joshi merely discloses a polymeric MDI as the polyisocyanate component and diols and triols as the polyol component. That is, Joshi fails to teach or suggest a combination of a mixture *only* consisting of bifunctional and trifunctional isocyanates and *only* a bifunctional polyol.

Moreover, some of the MDIs disclosed in Joshi are not even polyisocyanate. For example, Examples 14 and 15 of Joshi disclose SUPRASEC 2544 as a component. SUPRASEC 2544 is a prepolymer MDI instead of a polymeric MDI. The prepolymer MDI is not a polyisocyanate including bifunctional and trifunctional isocyanates.

Furthermore, Examples 14 and 15 of Joshi merely disclose that the reaction run at 110 Index, i.e., the isocyanate and polyol components are mixed with a molar ratio of NCO : -OH = 1.1:1.0. Examples 14 and 15 fail to teach or suggest that the isocyanate consisting of bifunctional and trifunctional isocyanates and the bifunctional polyol, having a molecular weight of from 100 to 250 and not being a chain extender, mixed with a molar ratio of NCO : -OH = 0.9 to 1.1 : 1.0. According to the present invention, this specific blend can produce an extended pot life of the matrix polymer without using any curing catalysts and can produce an increase of Tg of the matrix polymer (sections [0014], [0017], [0018], [0035], [0038] and [0055] and Table 2 of the published specification). There is no teaching or suggestion of such a blend in Joshi.

**(C) Fukami fails to teach or even teaches away from the use of only bifunctional polyol having an average molecular weight of from 100 to 250 and not being a chain extender as the polyol component of polyurethane.**

Fukami merely discloses that if the hydroxyl value of the polyols is smaller 300, the necessary rigidity for construction material cannot be obtained, while if it is larger than 800, impact resistance tends to be inferior. But Fukami does not disclose any reason for changing the molecular weight of the polyols.

Even if a person of ordinary skill in the art is to change the molecular weight of the polyols, he or she would not arrive at the claimed range of molecular weight based on Fukami because Fukami teaches low molecular weight polyols with the molecular weight below the claimed range of 100 to 250. For example, Fukami teaches “1,4-butane diol” as an example of “low molecular weight polyols.” Fukami, column 2, line 53. Yet 1,4-butane diol has a molecular weight of 90 and is a chain extender. Several other disclosed “low molecular weight polyols” have molecular weight outside the claimed range. For example, “ethylene glycol” has a molecular weight of 62, “propylene glycol” has a molecular weight of 76. *Id* at 50-54.

Accordingly, Applicants respectfully request that the rejection against claims 4-7, 10, 12, and 16-18 be withdrawn.

**(2) Josh in view of Fukami, Herrington and Blenner**

Claim 9 is rejected as allegedly being obvious over Joshi in view of Fukami, Herrington and U.S. Patent No. 4,738,999 (“Blenner”). Applicants respectfully disagree.

Because claim 9 depends from claim 6, Applicant’s amendments and arguments above also applies to the rejection against claim 9.

Applicants therefore respectfully request that this rejection be withdrawn.

### CONCLUSIONS

Applicants believe that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing or a credit card payment form being unsigned, providing incorrect information resulting in a rejected credit card transaction, or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicants hereby petition for such extension under 37 C.F.R. § 1.136 and authorize payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

Date October 21, 2011

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